

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTONREVIEW OF THE INDO-PACIFIC PIPEFISH GENUS
LISSOCAMPUS (SYNGNATHIDAE)

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My studies of the catch-all genus *Ichthyocampus* Kaup show that a number of nominal species assigned to *Ichthyocampus* are referable to other genera. I herewith review the genus *Lissocampus* Waite and Hale and include therein three species formerly placed in *Ichthyocampus*. Study material is limited but I have examined the pertinent types and illustrated each species. Other species now referred to *Ichthyocampus* will be treated in subsequent reports.

In *Lissocampus*, the anteriormost dorsal-fin ray is often obscured by the surrounding membrane. Length of dorsal-fin base is therefore here defined as: distance between anteriormost indication of elevated fin base and insertion of posteriormost fin ray. Other counts and measurements follow Dawson (1976). Color descriptions are from specimens preserved in alcohol; materials examined are usually listed only by general locality; depth is reported in meters (m).

Abbreviations for repositories of examined material: AMS—Australian Museum, Sydney; ANSP—Academy of Natural Sciences, Philadelphia; BMNH—British Museum (Natural History); BPBM—Bernice P. Bishop Museum; CAS—California Academy of Sciences; GCRL—Gulf Coast Research Laboratory Museum; HUJ—Hebrew University of Jerusalem; NMNZ—National Museum of New Zealand, Wellington; QVM—Queen Victoria Museum, Launceston, Tasmania; SAM—South Australian Museum, Adelaide; USNM—National Museum of Natural History, Smithsonian Institution; WAM—Western Australian Museum, Perth.

Lissocampus Waite and Hale

Lissocampus Waite and Hale, 1921:306 (type-species: *Lissocampus caudalis* Waite and Hale, 1921, by original designation).

Larvicampus Whitley, 1948:75 (type-species: *Festucalex (Campichthys) ruma* Whitley, 1931, by original designation).

Diagnosis: Superior trunk and tail ridges continuous; lateral trunk ridge continuous with inferior tail ridge; inferior trunk and tail ridges discontinuous near anal ring; median dorsal snout ridge low to distinctly elevated; opercular and other head ridges vestigial or obsolete; no ridges on pectoral-fin base; scutella oval, without keels; body ridges inconspicuous, little indented between rings; trunk somewhat V-shaped ventrad, without median longitudinal keel; devoid of spines or serrae, with or without dermal flaps. Dorsum of trunk and tail somewhat convex; venter of tail often convex; dorsal-fin base elevated anteriorly, adjacent surfaces of subdorsal rings sloped upward (Fig. 5); dorsal-fin membrane not closely bound throughout to fin rays, somewhat voluminous over basal third or half of fin and usually distinctly enlarged or sac-like in front. Head length (HL) 10.8–14.4 in standard length (SL); snout length 2.6–4.0 in head length; trunk rings 13–17; rings total 50–74; subdorsal rings 2.25–4.25, dorsal-fin origin on trunk; dorsal-fin rays 13–19; pectoral-fin rays 5–13; anal fin present; caudal-fin rays 10. Brood pouch under tail, without protective plates; brood-pouch eggs in 3–4 transverse rows (usually 2 layers deep) covered by protective folds which meet or nearly meet on ventral midline. Without odontoid processes in jaws (Dawson and Fritzsche, 1975); nares 2-pored bilaterally. Maximum size at least 132 mm SL. Red Sea, Australia, Tasmania, New Zealand and Chatham Is.; marine.

Comparisons: Among syngnathine (tail pouch) pipefishes, the *Lissocampus* configuration of principal body ridges is shared with *Penetopteryx* Lunel, *Urocampus* Günther and the western Atlantic *Ichthyocampus pauciei* Herald. The anal fin is absent in the latter species and *Penetopteryx* lacks dorsal, anal and pectoral fins (these fins present in *Lissocampus*). *Urocampus* and the somewhat similar *Siokunichthys* resemble *Lissocampus* in general appearance but the dorsal-fin base is not elevated in these genera and the dorsal fin originates on tail (fin base elevated anteriorly in *Lissocampus*, dorsal-fin origin on trunk).

Remarks: Waite and Hale (1921) diagnosed *Lissocampus* "without ridges" and this error was not corrected by subsequent authors (Munro, 1958; Scott, 1961, 1971). Body rings and ridges cannot be seen clearly on wet specimens and this may in part explain differences between published accounts and present observations from near-dry material; other discrepancies result from different methods of enumerating rings, etc. Difficulty may also occur in obtaining accurate counts of dorsal-fin rays, since one or more anterior rays may be concealed within the surrounding sac-like membrane. The membrane forms a swollen and somewhat turgid protuberance in many preserved specimens; in others, the space between

right and left membranes often entraps quantities of air when specimens are removed from preservative. Function of this dorsal-fin modification is unknown; it may be inflatable and could serve as a hydrostatic organ. In any event, I am unaware of a similar specialization in other syngnathids. Anal-fin rays 3-4, fin minute and, in mature males, concealed within the brood pouch.

Pouch folds are voluminous in males with well-developed eggs, but some eggs remain exposed since folds (in preserved material) fail to meet on ventral midline. Where eggs appear to be newly laid, pouch folds meet on midline and closure is the everted type of Herald (1959). Some males, without eggs, have folds rolled bilaterally inward in scroll-like fashion, and these fish may have recently discharged their brood.

Dermal flaps are present in all examined *L. bannwarthi* but flaps are variously present or absent in other species, without apparent correlation with standard length or sex. In some specimens, the persistent bases of dermal flaps appear as pimplelike projections. Flaps are often simple but may be branched or leaflike; Scott (1961) described variations in branching of "barbels" or mandibular flaps in *L. caudalis* from Tasmania.

KEY TO THE GENUS LISSOCAMPUS

1. Trunk rings 12-15; dorsal-fin rays 13-15; pectoral-fin rays 5-8 2
 Trunk rings 17; dorsal-fin rays 18-19; pectoral-fin rays 11-13 *bannwarthi*
2. Profile of snout straight, snout ridge high 3
 Profile of snout concave, snout ridge low 4
3. Tail rings 51-60; pectoral-fin rays modally 5 *caudalis*
 Tail rings 44-47; pectoral-fin rays modally 7 *fatiloquus*
4. Trunk rings 13-15, modally 14; subdorsal rings total 2.75-3.5, modally 3.25; brood pouch usually below 14-16 tail rings; New Zealand and Chatham Is. *filum*
 Trunk rings 13-14, modally 13; subdorsal rings total 2.25-3.0, modally 2.75; brood pouch usually below 12-13 tail rings; Australia and Tasmania *runa*

Lissocampus caudalis Waite and Hale

Figure 1

Lissocampus caudalis Waite and Hale, 1921:306, fig. 46 (Kangaroo Is., South Australia).

Diagnosis: Profile of snout essentially straight dorsad; margin of median dorsal snout ridge usually above or in line with dorsal margin of orbit; total rings 64-74; pectoral-fin rays modally 5.

Description: Dorsal-fin rays 13-14; rings 12-14 + 51-60 = 64-74; subdorsal rings 0.5-1.25 + 1.25-1.75 = 2.25-2.50; pectoral-fin rays 5-6, modally 5; see Tables 1-3 for additional counts. Proportional data based

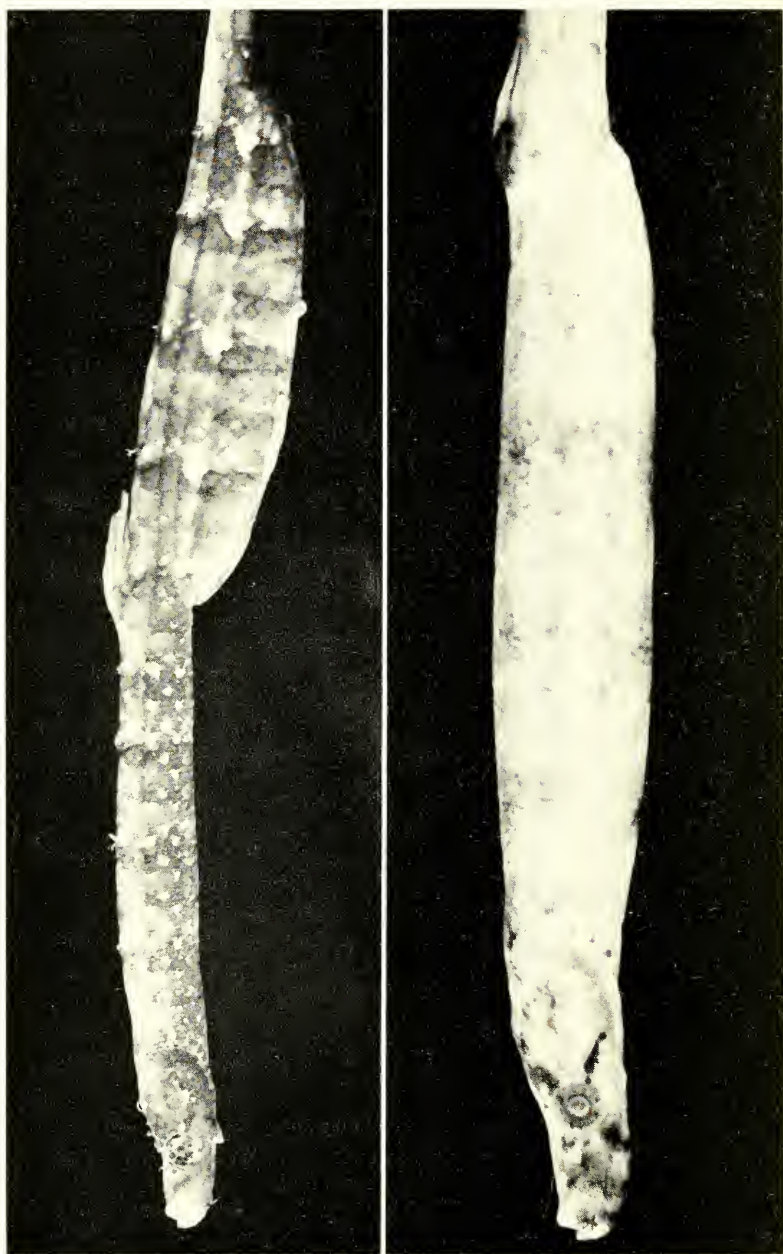


FIG. 1. Head and anterior body of *Lissocampus caudalis* QVM 1972/5/714. Top: Male, 80 mm SL. Bottom: Female, 75 mm SL.

on 5 Tasmanian specimens 70–90 ($\bar{x} = 78.1$) mm SL follow: HL in SL 12.7–14.0 (13.24); snout length in HL 3.0–3.4 (3.26); snout depth in snout length 1.3–1.4 (1.36); length of dorsal-fin base in HL 2.2–2.6 (2.42); anal ring depth in HL (3 fish) 3.2–3.4; pectoral-fin length in HL 3.4–3.8.

Cape subvertical; profile of head somewhat elevated behind eye but without distinct crest or ridges; operculum without ridge but surface waffled by low intersecting striae; pectoral-fin base 4–5 in pectoral-fin length. Dermal flaps simple to rather profusely branched; flaps may occur as follows: rather large flap, bilaterally, below angle of gape (mandibular flap); ring of minute simple flaps on eye; simple slender flap on dorsum of snout ridge above nares, one on dorsal rim of orbit, two on middorsal line of head, three on dorsolateral margin above opercle and one median flap on anterior third of opercle; flaps, often branched, on superior body ridges at about every 4th ring; lateral trunk ridge with branched flaps on every 4th ring and with smaller simple flaps on intervening rings. Anal-fin rays 3–4 in three specimens counted. Brood pouch below 13–16 tail rings in 3 males 76–90 mm SL, one (Fig. 1) contained about 49 eggs in pouch.

Dorsal-fin with brown blotch or bar anteriorly, rays elsewhere plain or flecked with brown; caudal and pectoral fins plain or flecked with brown. Body coloration variably tan to dark brown (Fig. 1), markings brown or white; well-pigmented specimens with diffuse brown bands (best seen on dorsum) separated by similarly diffuse tan or white interspaces; sides and venter of trunk often flecked or spotted with white; brood-pouch folds with indications of irregular narrow white bars.

Comparisons: The snout ridge of *Lissocampus caudalis* is higher than that of any congener and this species also has the highest tail ring counts (51 or more against 49 or less). The straight snout ridge is shared with *L. fatiloquus* but these species differ in counts of pectoral-fin rays (modally 5 against 7 in *fatiloquus*) and other characters. See *L. fatiloquus* for further comparisons.

Remarks: The female holotype has only 12 trunk rings but appears to be atypical; the rear margin of the last trunk ring is angled caudad, rather than subvertical, and anal fin insertion is near middle of 1st tail ring, rather than near vertical from its anterodorsal margin. Caudal fin is damaged but there appear to be 10 rays, and there seem to be 4 basal elements in the minute anal fin. The snout ridge extends above level of dorsal margin of orbit; vestiges of dermal flaps persist on eye, rim of orbit, middorsal line of head, above opercle, and on most trunk rings; mandibular flaps are lacking; no evidence of color pattern remains. Measurements (mm) follow: SL 95.0, HL 6.3, snout length 1.9, snout depth 1.6, length of dorsal-fin base 3.1, anal ring depth 2.1, pectoral-fin length 1.9, length of pectoral-fin base 0.5; see Tables 1–3 for counts.

Total ring counts of the type-material (71–74) are higher than that of compared Tasmanian fish (64–68) and additional study specimens may demonstrate clinal variation between northern and southern populations.

TABLE 1. Frequency distributions of trunk, tail and total rings in species of *Lissocampus*.

Character	Species				
	<i>caudalis</i>	<i>fatioloquus</i>	<i>filum</i>	<i>runa</i>	<i>bannwarthi</i>
Trunk rings					
12	1*				
13	6	6*	1	23*	
14	1		39*	2	
15			6		
17					11*
Tail rings					
33					4
34					6*
35					1
44		1	1		
45		1*	12	4	
46		3	14	13	
47		1	16	6*	
48			3*	1	
49				1	
51	1				
52	1				
54	3				
55	1				
59	1*				
60	1				
Total rings					
50					4
51					6*
52					1
57		1			
58		1*	2	4	
59		3	11	11	
60		1	10	8*	
61			18	1	
62			5*	1	
64	1				
65	1				
67	3				
68	1				
71	1*				
74	1				

* Primary type.

TABLE 2. Frequency distributions of dorsal and pectoral-fin rays and paired (equivalent) pectoral ray counts in species of *Lissocampus*.

Character	Species				
	<i>caudalis</i>	<i>fatioquus</i>	<i>filum</i>	<i>runa</i>	<i>bannwarthi</i>
Dorsal-fin rays					
13	5*			1	
14	3	6*	47*	27	
15			1	2*	
18					10*
19					1
Pectoral-fin rays					
5	11				
6	5*		7	17	
7		11*	67	38*	
8		1	6*		
11					2
12					16*
13					3
Paired pectoral counts					
5	5				
6	2*		1	5	
7		5*	28	15*	
8			1*		
12					5*

* Primary type.

Distribution: *Lissocampus caudalis* has been reported only from Australia and Tasmania. Scott (1961) noted collections from kelp and other material has come from "rock pools" (USNM 216291) and *Zostera* (QVM 1972/5/714).

Material examined: Eight specimens, 68–100 mm SL, including holotype and paratype. Holotype: SAM F.701 (95 mm SL, female), near Kangaroo Is., South Australia, 2 Oct. 1901, M. Rumball. Paratype: SAM F.702 (100 mm SL, female), data as for holotype. Other material: TASMANIA. GCRL I-4765, (1). QVM 1972/5/714, (4). USNM 216291, (1).

Lissocampus fatioquus (Whitley)

Figure 2

Iclthyocampus filum Günther, 1870:170 (in part, Freycinet's Harbor).
Campichthys fatioquus Whitley, 1943:176, fig. 7 (Shark's Bay, Western Australia).

TABLE 3. Frequency distributions of trunk, tail and total subdorsal rings in species of *Lissocampus*.

Character	Species				
	<i>caudalis</i>	<i>fatioquus</i>	<i>filum</i>	<i>runa</i>	<i>banurwarthi</i>
Trunk rings covered					
2.50			10		
2.25			8	4	1
2.00		1	25	17*	4
1.75		3	4*	8	4
1.50		1*		1	2*
1.25	1	1			
1.00	3				
0.75	3*				
0.50	1				
Tail rings covered					
0.50			5	10	
0.75			5	8	
1.00		1	17	11*	
1.25	3	2*	8	1	
1.50	4*	1	12*		
1.75	1	2			2
2.00					2
2.25					7*
Total subdorsal rings					
2.25	6*			1	
2.50	2			9	
2.75		1	2	12	
3.00		4*	14	8*	
3.25		1	19*		
3.50			12		
3.75					4*
4.00					4
4.25					3

* Primary type.

Larvicampus fatioquus, Whitley and Allan, 1958:60 (new combination).
Ichthyocampus fatioquus, Munro, 1958:88, fig. 608 (new combination).

Diagnosis: Profile of snout essentially straight dorsad; margin of median dorsal snout ridge slightly below or in line with dorsal margin of orbit; total rings 57–60; pectoral-fin rays modally 7.

Description: Dorsal-fin rays 14; rings $13 + 44-47 = 57-60$; subdorsal

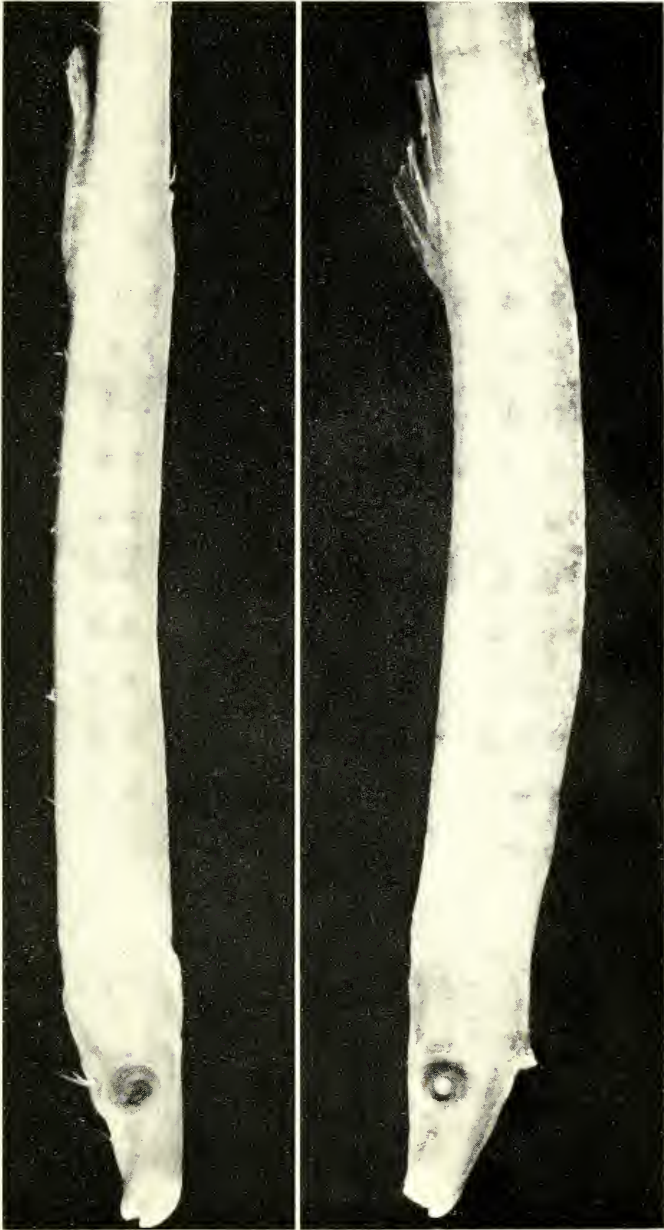


FIG. 2. Head and anterior body of *Lissocampus fatiloquus*. Top: AMS IB.340; 62 mm SL, holotype. Bottom: AMS IB.341; 74 mm SL, male.

rings $1.25-2.00 + 1.00-1.75 = 2.75-3.25$; pectoral-fin rays 7-8, modally 7; see Tables 1-3 for additional counts. Proportional data based on 6 specimens 62-79 ($\bar{x} = 70.7$) mm SL follow: HL in SL 11.8-13.4 (12.65); snout depth in snout length 1.2-1.9 (1.57); length of dorsal-fin base in HL 1.8-2.0 (1.90); anal ring depth in HL 3.3-3.7; pectoral-fin length in HL 3.7-4.5 (last two proportions each based on 3 fish).

Cape approaches angle of 70° in holotype, subvertical in other material; dorsum of head straight to slightly elevated behind eye, without crest or ridges; opercle without ridge but lined with minute radiating striae; pectoral-fin base 2-3 in pectoral-fin length. Dermal flaps slender, simple in all material examined. Holotype with long flaps on snout ridge and dorsal rim of orbit, circle of minute flaps on eye, flap on mid-dorsum above middle of opercle, another laterad above posterior third of opercle and a short flap anterior near midline of opercle. Flaps present on superior ridges of most rings and on lateral ridge of most trunk rings; some flaps occur on side of tail and, less frequently, on inferior tail ridges.

Anal-fin rays 3 in holotype and two others examined. Brood pouch below 13 and 16 tail rings in two 74 mm SL males; both without eggs and pouch folds little developed.

Study material faded; traces of brown bar or blotch persist on anterior third of dorsal fin in all specimens. The holotype and AMS IB.341 (Fig. 2) retain paired brownish spots on lateral and inferior ridges of most trunk rings; other markings best preserved in the latter specimen and appear as a series of about 20 ill-defined brownish bands between head and caudal fin, dorsum rather pale and markings best seen on venter and lower part of sides.

Comparisons: The straight and relatively high snout ridge separates *L. fatiloquus* from all congeners except *L. caudalis*. It is separated from this species by higher modal counts of pectoral-fin rays (7 against 5 in *caudalis*) and by lower tail ring counts (44-47 against 51-60 in *caudalis*). These are very similar forms and differences in tail ring counts could well be ascribed to clinal variation between northern and southern populations. Modal pectoral-fin ray counts and frequency of equivalent paired (left and right) pectoral counts (Table 2) are conservative characters in many pipefishes (Dawson and Randall, 1975; Dawson, in press) and I consider differences observed here to support separate status for *L. fatiloquus*.

Remarks: I have examined the type-material of *Lissocampus affinis* (= *L. nana*, q.v.) Whitley (1944) and find the single paratype (AMS IB.341, 74 mm SL, male) to be conspecific with *L. fatiloquus*. This specimen was also dredged by Whitley in Shark's Bay during 1939 and may have been collected with the holotype of *L. fatiloquus*.

Günther (1870) recorded two males from Freycinet's Harbor among his syntypes of *Ichthyocampus filum* and Whitley (1943) speculated that these were most likely specimens of *Lissocampus fatiloquus*. The BMNH collection contains a male and female in an uncataloged lot, without

locality data, originally identified as *Ichthyocampus filum*. I find these specimens to be *Lissocampus fatiloquus* and A. C. Wheeler (BMNH) advises that they must be Günther's Freycinet Harbor material.

This species is, with certainty, known only from Western Australia. Two specimens were dredged, collection data lacking for other material.

Material examined: Six specimens, 62–79 mm SL, including holotype. Holotype: AMS IB.340 (62 mm SL), Western Australia, Shark's Bay, dredged on pearling grounds, 1939, G. P. Whitley. Other material: WESTERN AUSTRALIA, AMS IB.341, (1), paratype of *L. affinis*. WAM uncat., (2). Loc. uncertain: BMNH uncat., (2, presumably the Freycinet Harbor syntypes of *Ichthyocampus filum*).

Lissocampus filum (Günther)

Figure 3

Ichthyocampus filum Günther, 1870:178 (in part; Bay of Islands).

Diagnosis: Profile of snout distinctly concave dorsad; margin of median dorsal snout ridge well below dorsal margin of orbit; trunk rings modally 14.

Description: Dorsal-fin rays 14–15; rings 13–15 + 44–48 = 58–62; subdorsal rings 1.75–2.50 + 0.50–1.50 = 2.75–3.50; pectoral-fin rays 6–8, modally 7; see Tables 1–3 for additional counts. Proportional data based on 32 specimens 62.5–107 (\bar{x} = 88.6) mm SL follow: HL in SL 11.8–14.4 (13.36); snout length in HL 3.2–4.0 (3.48); snout depth in snout length 1.3–2.0 (1.54), in 19 specimens; length of dorsal-fin base in HL 1.4–1.9 (1.62); anal ring depth in HL 2.4–3.6 (2.91), in 17 specimens; pectoral-fin length in HL 3.8–5.0 (4.4), in 15 specimens.

Cape approximates angle of 70° in most material, occasionally sub-vertical; median dorsal snout ridge low throughout; dorsum of head elevated behind eye, low fleshy nuchal and prenuchal ridges usually present; opercle with low radiating striae, occasionally with vestigial longitudinal ridge anterior; pectoral-fin base 2–3 in pectoral-fin length. Dermal flaps slender, short and usually simple, often indicated only by residual pimplelike bases. Flaps may be located as follows: a circlelet on eye; flap on snout ridge before eye, one on dorsal margin of orbit and 2–3 behind on middorsum of head; 3 flaps laterad above opercle, 3–5 on fleshy posterior margin of opercle and a median flap on anterior third of opercle; superior, inferior and lateral body ridges with flaps on each ring; flaps often present on tail ridges, midlaterally on tail and on brood pouch folds.

Anal-fin rays 3 in 19 of 22 specimens, 4 in remainder. Brood pouch below 13–16 tail rings in 15 examined males 71–107 mm SL; a 96 mm fish (GCRL 14826) had 86 eggs in pouch.

Dorsal fin with brown blotch or bar anterior, the rays elsewhere plain or flecked with brown; caudal and pectoral fins plain or flecked with brown, caudal base and proximal third of fin brownish in pale material. Body coloration variably light tan to dark brown (Fig. 3), markings brown.

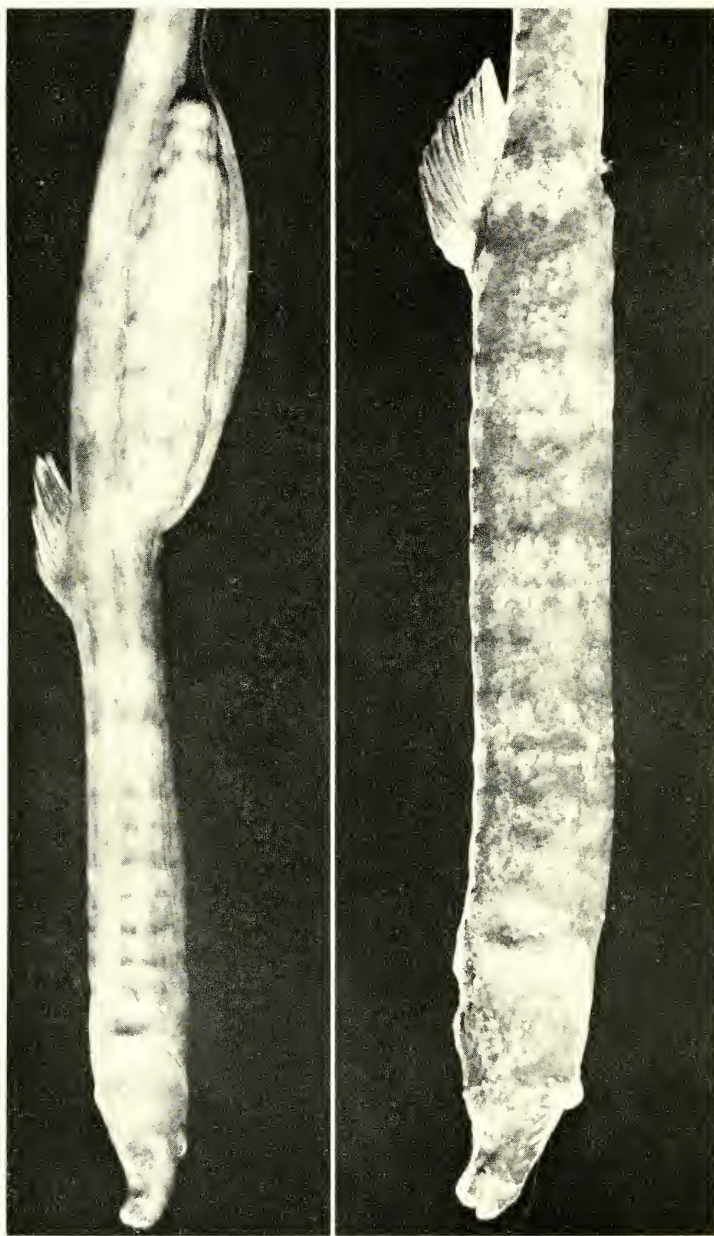


FIG. 3. Head and anterior body of *Lissocampus filum*. Top: GCRL 14827; 93 mm SL, male. Bottom: GCRL 14826; 92 mm SL, female.

Tan material usually with irregular light brown shading on sides and venter of head; venter and lower half of trunk brownish, often with indications of narrow bars, markings darker anteriorly becoming obsolete behind; dorsum crossed by traces of 10–12 irregularly spaced, indistinct brownish bars, subequal to ring length, which may continue a short distance ventrad on sides; brood-pouch folds with indications of 3 widely spaced narrow bars; body elsewhere irregularly and faintly flecked or spotted with brown. Dark specimens with diffuse dark brown bands separated by narrower brown interspaces, dorsum somewhat lighter than sides and venter; some fish with a few pale spots near pectoral-fin base and along lower side of trunk; males often with irregular narrow brown longitudinal lines or streaks on trunk and brood-pouch folds. None of examined material with contrasting sequence of dark brown and white or pale bars.

Comparisons: Among species with 13–15 trunk rings, *L. filum* is readily separated from *L. caudalis* and *L. fatiloquus* by the low snout ridge and concave profile of snout (ridge high, profile straight in *caudalis* and *fatiloquus*). This species is closely related to *L. ruma* but differs in modal trunk ring counts (14 against 13 in *ruma*) and higher average number of subdorsal rings (3.2 against 2.7). I have not seen specimens of *L. filum* with prominently contrasting bands of brown and white, whereas this color pattern occurs in some specimens of *L. ruma*.

Remarks: Günther's (1870) description was based on specimens from Australia and New Zealand. Whitley (1931) assumed that two species were included in Günther's material and restricted the type-locality of *Ichthyocampus filum* to the Bay of Islands, New Zealand (see under *fatiloquus* for discussion of Australian syntypes).

I have examined the Bay of Islands syntypes (BMNH uncat.) and select the mature male (ca. 91.5 mm SL) as the lectotype of *Ichthyocampus filum*. This specimen is brittle and somewhat distorted but the following measurements (mm) were obtained: HL 7.1, snout length 2.1, snout depth 1.3, length of dorsal-fin base 3.4. The pectoral fins are somewhat damaged but there appear to be 8 rays in each; see Tables 1–3 for other counts. Eight eggs remain in the pouch, no dermal flaps persist and the specimen is faded except for traces of a brown blotch anteriorly on dorsal fin.

One specimen examined (NMNZ 25646) is from Port Pegasus, Stewart Is., off the southern tip of South Island, New Zealand; remaining material was collected from Cook Strait north to Cavalli Is. off North Island, N.Z. and from the Chatham Is. Dr. J. Moreland (NMNZ) advises that this species occurs along both east and west coasts of South Island, New Zealand. Depth records for four lots range from "sublittoral" to 6.1 m; one collection (NMNZ 6915) is from a rockpool.

Material examined: Fifty-one specimens, 35–107 mm SL, including lectotype and two paralectotypes. Lectotype: BMNH uncat. (ca. 91.5 mm SL, male), New Zealand, Bay of Islands, Sir G. Gray, donor. Paralectotypes: BMNH uncat. (2 females; one ca. 82.5, other damaged), data

as for lectotype. Other material: NEW ZEALAND. ANSP 119329, (2); 119330, (1); 119331, (2). BMNH 1886.11.19.101, (1). CAS 15154, (1). GCRL 14826, (2); 14827, (3). HUI uncat., (2). NMNZ 1309, (5); 3134, (1); 3223, (1); 3250, (2); 3427, (3); 4096, (2); 5646, (1); 6583, (4); 6584, (11). USNM 216302, (2). CHATHAM IS., KAINGAROA. NMNZ 6915, (2).

Lissocampus runa (Whitley)

Figure 4

Ichthyocampus filum (non Günther, 1870), McCulloch, 1909:318, pl. 90, fig. 1 (Sydney, New South Wales).

Festucalex (*Campichthys*) *runa* Whitley, 1931:313 (new name for McCulloch's material).

Lissocampus affinis Whitley, 1944:266 (Rottnest Is., Western Australia).

Larvicampus runa Whitley, 1948:75 (type-species of *Larvicampus* Whitley, 1948).

Festucalex runa, Herald, 1953:236 (as junior synonym of *Ichthyocampus filum* Günther).

Ichthyocampus runa, Munro, 1958:88, fig. 609 (new combination).

Diagnosis: Profile of snout distinctly concave dorsad; margin of median dorsal snout ridge well below dorsal margin of orbit; trunk rings modally 13.

Description: Dorsal-fin rays 13–15; rings 13–14 + 45–49 = 58–62; subdorsal rings 1.5–2.25 + 0.5–1.25 = 2.25–3.0; pectoral-fin rays 6–7, modally 7; see Tables 1–3 for additional counts. Proportional data based on 19 specimens 63.5–92 (\bar{x} = 77.7) mm SL follow: HL in SL 11.6–13.9 (12.76); snout length in HL 2.8–3.4 (3.20); snout depth in snout length 1.2–2.0 (1.50), in 12 specimens; length of dorsal-fin base in HL 1.8–2.3 (2.00); anal ring depth in HL 2.2–3.8 (3.05), 8 fish; pectoral-fin length in HL 4.7–6.0 in 4 fish.

Gape usually subvertical; median dorsal snout ridge low; profile of head elevated behind eye, often with indications of low fleshy nuchal and prenuchal ridges; operculum with indistinct radiating striae, infrequently with vestigial ridge anteriorly; pectoral-fin base 2–3 in pectoral-fin length. Dermal flaps typically simple in examined material, often indicated only by low pimplelike projections and similar projections may be scattered irregularly over much of body (Fig. 5). Flaps located bilaterally on side of snout behind gape, distribution otherwise similar to that described for *L. filum*.

Anal-fin rays 3 in 16 of 17 specimens, 4 in remainder. Brood pouch below 12–14 tail rings in 11 males 69–86 mm SL; an immature 75 mm specimen had pouch folds below 8 tail rings.

Dorsal fin with indication of brown blotch or bar in front, fin elsewhere mainly pale but some fish with rays lightly flecked with brown; pectoral and caudal fins usually pale. Most material obviously faded but body coloration variably tan to dark brown, markings brown. Tan

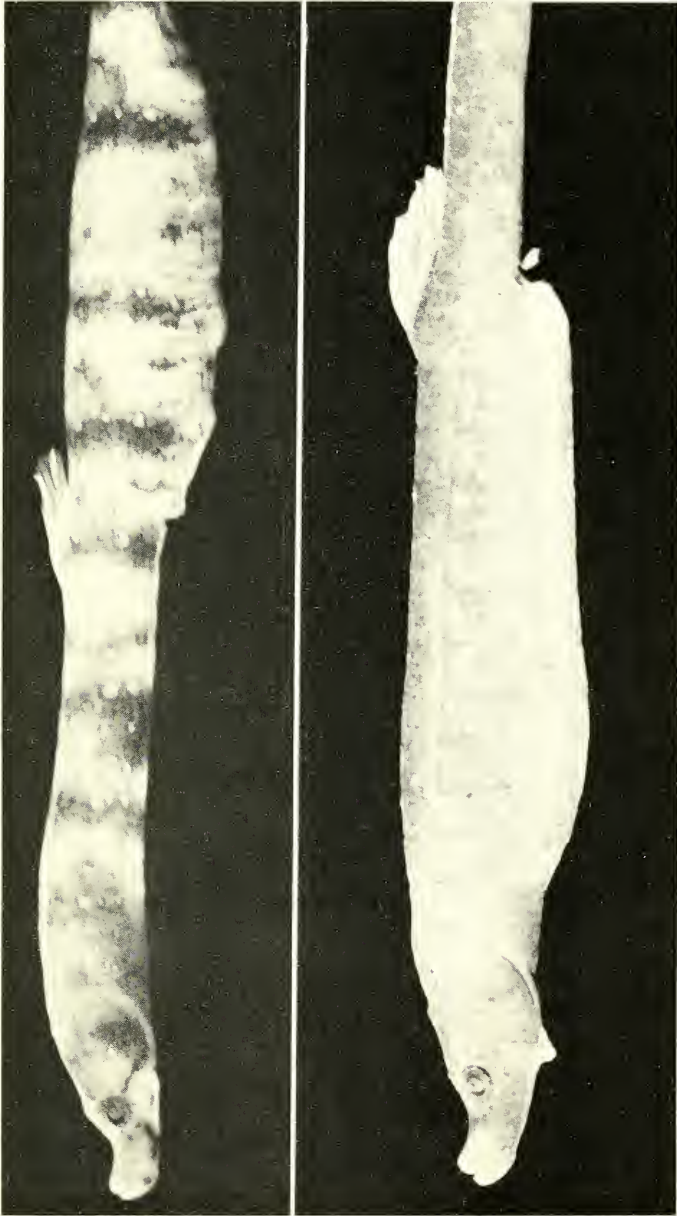


FIG. 4. Head and anterior body of *Lissocampus rufa*. Top: USNM 216290; 78 mm SL, male. Bottom: AMS I.13719; 92 mm SL, female.

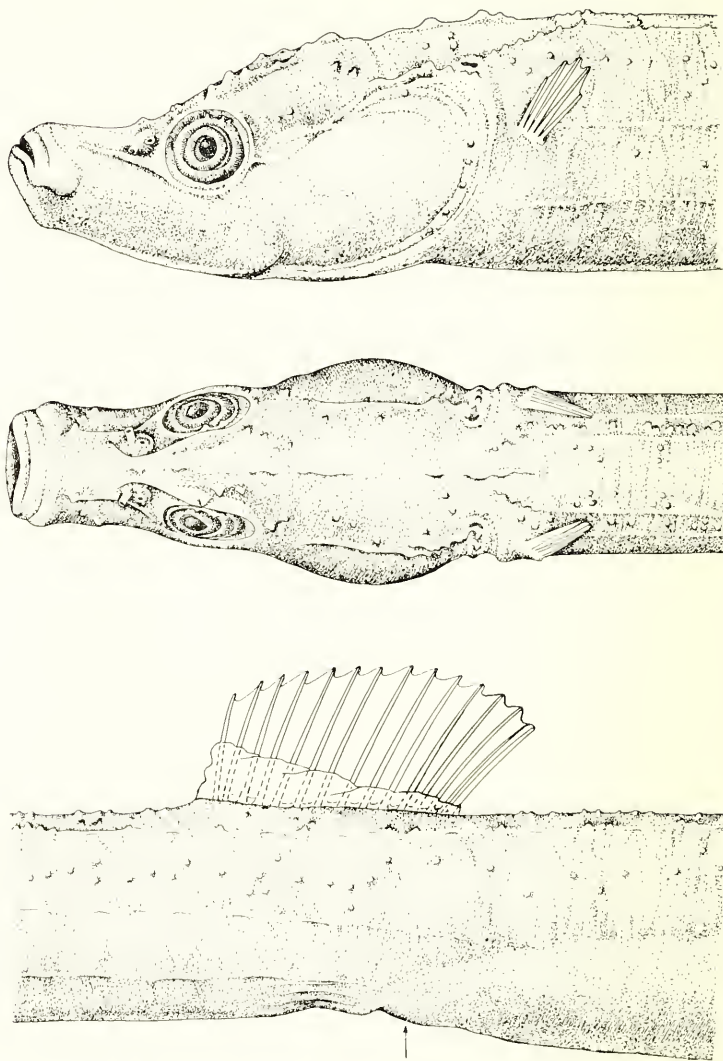


FIG. 5. *Lissocampus rna* AMS I.9020, lectotype. Top and middle: Lateral and dorsal aspects of head and anterior trunk rings; indicated head ridges fleshy. Bottom: Section of body illustrating ridges, elevated dorsal-fin base, modified dorsal-fin membrane and pimplelike projections; arrow indicates approximate position of anal fin within brood-pouch folds. Some flaps omitted.

specimens with irregularly brownish shading on head; lower portion of sides and venter of trunk somewhat brownish, often with traces of narrow dark bars; dorsum with indications of broad bars (2–3 rings long), body elsewhere lightly and irregularly flecked or spotted with brown. Dark specimens with posterior third of opercle pale and indications of dark bars on body; occasionally with minute pale spots near pectoral-fin base and on bases of dermal flaps. Several males distinctly banded with brown and white (Fig. 4); 4–5 bands on trunk, 12–16 on tail and with 4–6 bands crossing brood-pouch folds.

Comparisons: *Lissocampus runa* is closely related to *L. filum* and differs mainly in having a lower modal trunk ring count (13 against 14 in *filum*) and a lower average number of subdorsal rings (2.7 against 3.2). The brood pouch of *L. runa* usually (83%) extends below 12–13 tail rings whereas the brood pouch includes 14–16 rings in 93% of examined *L. filum*. The contrasting banded coloration of some *L. runa* (Fig. 4) did not occur in examined *L. filum*, but fresh study material was not available for adequate comparisons. Modal trunk ring frequency is a highly conservative character and I consider this difference to be a sufficient basis for separate treatment of these species.

Remarks: The syntypes of *Festucalex (Campichthys) runa* (AMS I.9020) consist of two specimens and I select the male (82.5 mm SL) as the lectotype. This fish is faded; the last two dorsal-fin rays are approximated rather than more or less equally spaced as in most other specimens; brood pouch extends below 14 tail rings. Measurements (mm) follow: HL 6.2, snout length 2.2, snout depth 1.5, length of dorsal-fin base 3.4, anal ring depth 2.5, pectoral-fin length 1.3, length of pectoral-fin base 0.5.

Whitley (1944) reported the holotype of *Lissocampus affinis* to have 11 dorsal-fin rays, 5 pectoral-fin rays, 9 caudal rays, 12 + 46 rings, no anal fin, and that the dorsal fin was located over the last two body rings. My counts from this specimen follow: dorsal 13, pectoral 6 on each side, caudal 10, rings 13 + 46, anal fin present within brood-pouch folds, subdorsal rings 1.75 + 0.75. The dorsal fin is evidently anomalous in that there is an exceptionally wide space between the 7th–8th rays, the undamaged membrane suggests that one fin-ray failed to develop. I find no substantial differences in residual coloration or other characters and consider the specimen conspecific with *Lissocampus runa*. The specimen of *L. affinis* (SAM F.3245) reported by Glover (1968) and Scott, *et al.* (1974) is also referred to *L. runa*.

This species is known only from Australia and Tasmania; two collections are reported from “rockpools.”

Material examined: Thirty-one specimens, 44–92 mm SL, including lectotype and paralectotype. Lectotype: AMS I.9020 (82.5 mm SL, male), Australia, New South Wales, Long Bay, Sydney, July 1907, A. R. McCulloch, donor. Paralectotype: AMS I.9020 (63.5 mm SL), data as for lectotype. Other material: WESTERN AUSTRALIA. WAM P.1150 (holotype of *L. affinis*). USNM 216290, (1). SOUTH AUSTRALIA. SAM



FIG. 6. Head and anterior body of *Lissocampus bannwarthi*. GCRL 14820; 105 mm SL.

F.3245, (1); F.3440, (1). NEW SOUTH WALES. AMS L9268, (9); I.9956-7, (3); I.13719, (2); IA.6195, (1); IA.1243, (2). CAS 36585, (1). USNM 84381, (3); 88269, (1). TASMANIA. AMS I.17543-001, (1). QVM 1976/5 93, 1976/5 131, 1976/5 142.

Lissocampus bannwarthi (Duncker)

Figure 6

Ichthyocampus bannwarthi Duncker, 1915:93 (Suez).

Diagnosis: Profile of snout broadly concave dorsad; margin of median snout ridge below dorsal margin of orbit; total rings 50-52; pectoral-fin rays 11-13.

Description: Dorsal-fin rays 18-19; rings $17 + 33-35 = 50-52$; sub-dorsal rings $1.5-2.25 + 1.75-2.25 = 3.75-4.25$; pectoral-fin rays 11-13, modally 12; see Tables 1-3 for additional counts. Proportional data on 11 specimens 101-132 ($\bar{x} = 109.8$) mm SL follow: HL in SL 10.8-11.9 (11.34); snout length in HL 2.6-2.8 (2.69); snout depth in snout length 2.5-2.9 (2.75); length of dorsal-fin base in HL 1.3-1.5 (1.41); anal ring depth in HL 2.6-3.4 (3.03); pectoral-fin length in HL 3.9-5.2 (4.64).

Gape subvertical; median dorsal snout ridge (Fig. 7) low but angled somewhat dorsad before eyes; dorsum of head elevated, rounded and without ridges; operculum waffled with minute intersecting low striae, usually with vestigial ridge anteriad; dorsal-fin base elevated anteriad; dorsal-fin membrane usually somewhat swollen or enlarged about anterior 4-5 fin rays; pectoral-fin base 1.4-1.8 in pectoral-fin length. Dermal flaps well developed, usually branched or frilled on head and trunk but frequently simple on posterior third of tail; midlateral flaps often present on tail rings. Anal-fin rays 4 in 7 of 11 specimens, 3 in remainder.

Dorsal fin with brownish blotch on membrane anteriad; dorsal, anal and pectoral-fin rays faintly margined with brown; caudal fin with light brown shading. Sides and dorsum of head irregularly shaded with brown over light tan ground color, usually with irregular patch of several dark brown ocellated spots dorsolaterad behind eye, often with similar patch

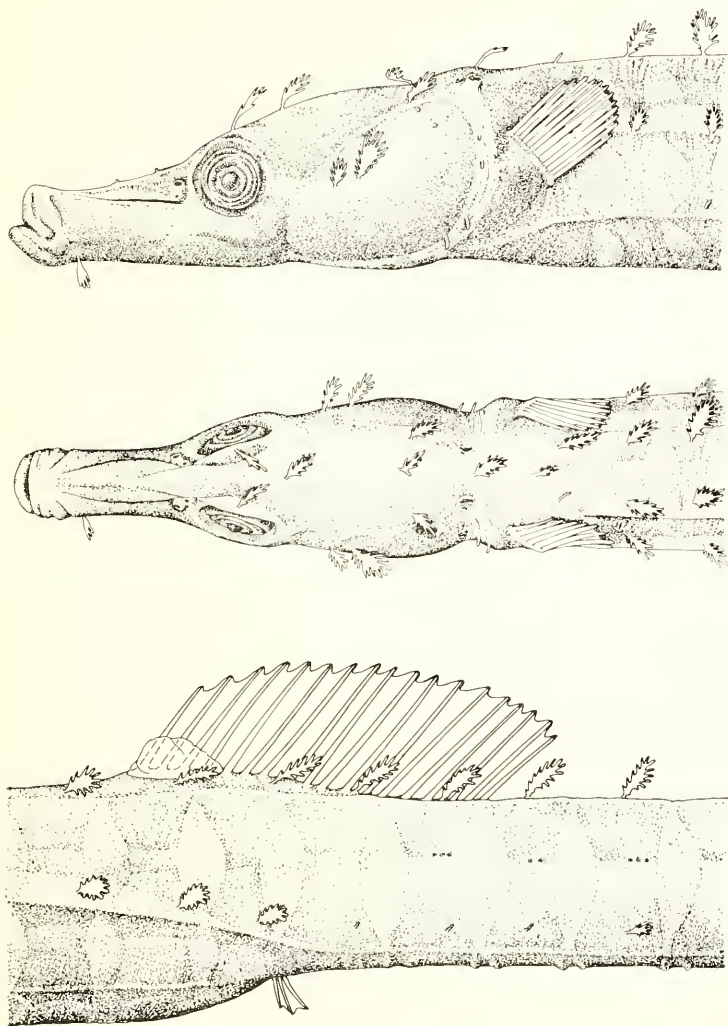


FIG. 7. *Lissocampus bannwarthi* USNM 216292, neotype. Top and middle: Lateral and dorsal aspects of head and anterior trunk rings. Bottom: Section of body illustrating ridges, dermal flaps, dorsal and anal fins.

on interorbital; venter of head pale with irregular scattering of medium brown spots or blotches. Sides and dorsum of body with indications of about 20 irregular, diffuse, dark bands (Fig. 6), most distinct on upper part of sides and each usually includes an irregular patch of ocellate dark spots; trunk with venter and lower part of sides medium brown, sides often with irregular tan spots ventrad; venter of tail brown or more frequently, with irregular series of barlike blotches. Color description from recently collected material (BPBM 19832, GCRL 14820).

Comparisons: *Lissocampus bannwarthi* is readily separable by characters in the key and other meristic differences (Tables 1-3). This species further differs from known congeners in having a less extensive modification of the dorsal-fin membrane and in the modal count of 4 rather than 3 anal-fin rays.

Remarks: Mature males were not available and information is lacking on brood-pouch eggs or type of pouch closure. Duncker (1915) stated that pouch protective plates were absent and that the brood-pouch extended below 17-18 tail rings.

Duncker's type-material, deposited in the Hamburg Museum, was destroyed during World War II. I therefore select USNM 216292 (Fig. 7) as the neotype of *Ichthyocampus bannwarthi*. Measurements (mm) of this 122.5 mm SL specimen follow: HL 10.6, snout length 4.0, snout depth 1.4, length of dorsal-fin base 7.2, anal ring depth 4.0, pectoral-fin length 2.7, length of pectoral-fin base 1.6; see Tables 1-3 for counts.

This species, listed as a possible Red Sea endemic by Botros (1971), has been illustrated previously by Hora (1925, pl. 10, fig. 3) but it has seldom been recorded in literature and there are few specimens in collections. This is somewhat surprising, since present material was taken in depths of 0-2.4 m. Previous records are as follows: Suez (Duncker, 1915), Sinai Peninsula (Hora, 1925), Ghardaqa (Duncker, 1940).

Material examined: Eleven specimens, 101-132 mm SL, including neotype. Neotype: USNM 216292 (122.5 mm SL, presumably female), Red Sea, 27°16'46"N, 33°46'25"E, 0-2.4 m, 1 Jan. 1965, L. Kornicker and H. A. Fehlmann. Other material: RED SEA. BPBM 19832, (8), GCRL 14210, (2), Gulf of Aqaba, NW shore, El Muzeini, N of Nuweiba, sand and small rocks, 0-0.5 m, 31 Oct. 1975, J. E. Randall and J. Vendling.

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